IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: A.N. Neogi et al. Attorney Docket No.: WEYE120773/25194

Application No.: 10/602,208 Art Unit: 1773 / Confirmation No: 2234

Filed: June 23, 2003 Examiner: L.B. Kiliman

Title: METHODS FOR ESTERIFYING HYDROXYL GROUPS IN WOOD

DECLARATION UNDER 37 C.F.R. § 1.132

Federal Way, Washington 98063

March 29, 2006

TO THE COMMISSIONER FOR PATENTS:

I, James Shaw, hereby state:

1. I am a co-inventor of the subject matter described and claimed in the above-identified patent application.

2. I am a research scientist at Weyerhaeuser Company (hereinafter referred to as "Weyerhaeuser"), assignee of the patent application.

3. I have a Doctor of Philosophy degree in Organic Chemistry from the University of Utah, June 1973.

4. For the last 29 years, I have worked for Weyerhaeuser, researching in areas including fire technology, fire retardants for cellulosic materials, wood preservation and wood modification.

5. During this time, I have worked with the concept of esterifying hydroxyl groups in wood at the Weyerhaeuser Company.

6. I have carefully reviewed and considered the patent application, including the claims.

7. It was determined that a large reactor and load would be needed to make the esterification process economical and useful to Weyerhaeuser.

8. This meant that the load would have to have a cross-section in the order of 4 feet x 4 feet.

9. It was computed from public literature that the heating pattern would be poor (giving product degrade) if the available microwave heating systems were used with these large cross-section, commercial-sized loads.

10. The microwave frequencies, therefore, did not appear useful to Weyerhaeuser for this process.

11. At the higher microwave frequencies the electromagnetic energy cannot penetrate deeply into the load.

12. This means the surface is hot – but the center is cold and poor heating uniformity results.

13. In addition, it was believed that the lumber load would have to be restrained during the drying stage to prevent product degrade.

14. This meant the metal electrodes needed for the low frequency heating system would have the added benefit of restraining the lumber and preventing bowing, etc. during the process.

15. Metal near the load at microwave frequencies normally reduces the heating in that area and contributes to poor heating uniformity and product degradation.

16. Microwave systems could use non-metal devices to provide restraint – but the cost would be much higher.

17. These devices would have to be made of a material that will not heat significantly in the electromagnetic fields.

18. A lower frequency range, namely, 3 to 30 MHz was selected for investigation.

19. It was hypothesized that electromagnetic heating at a much lower frequency (larger wavelength) would provide more uniform heating and less product degradation for the following reasons:

a. At the lower frequencies, the electromagnetic waves are not "traveling waves" – but "standing waves".

i. This means that electric fields oscillate between the electrodes provided above and below the load.

ii. This encourages relatively uniform heating.

iii. At the higher microwave frequencies the electromagnetic waves travel around the metal chamber and create locations that have high electric fields and others that have low electric fields.

iv. This is because the chamber acts as a resonant cavity.

v. This causes hot and cold spots in the load and subsequently, poor heating uniformity.

20. Since there was no public data on the electrical properties of the materials at these lower frequencies, experiments were carried out by Weyerhaeuser to measure the relevant electrical properties at 6.78 MHz.

21. Weyerhaeuser, thereby, discovered that the heating pattern would be significantly improved at the lower frequency over the available microwave frequency power systems.

22. These heating uniformity improvements at lower frequencies are due to two reasons:

a. At the lower frequencies the electromagnetic wave energy can penetrate further into a large cross-section load.

i. This means that the center of the load will be heated in roughly the same way as the surface of the load.

ii. This lowers heating and drying degradation in the product.

23. At about the same time as the electrical properties were being measured, Weyerhaeuser carried out lab trials at 6.78 MHz and discovered that these lower frequencies (well below 300 MHz and the microwave region) could also be used to achieve the desired heating, acetylation and product quality.

24. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

DATE: March 27, 2006

James Shaw